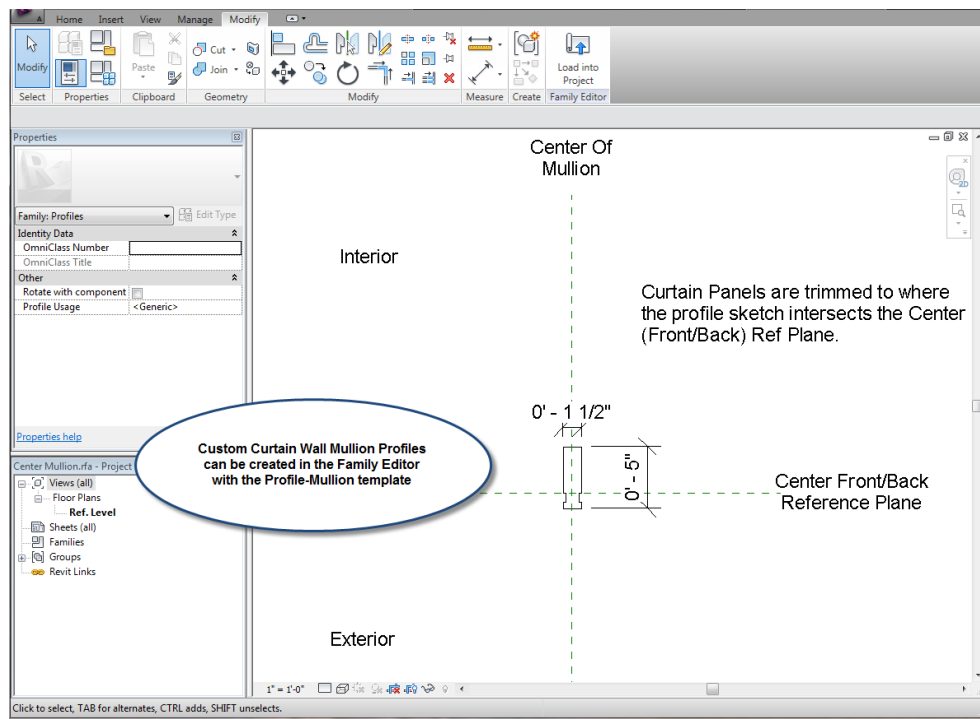


AGENDA:

1. Custom Curtain Wall Mullion Profile Families
2. Custom Curtain Wall Panel Families

1. Custom Curtain Wall Profile Families

Revit allows you to create custom curtain wall mullion profile families in the Family Editor. To create a new Mullion Profile family, start a new family with the Profile Mullion template.

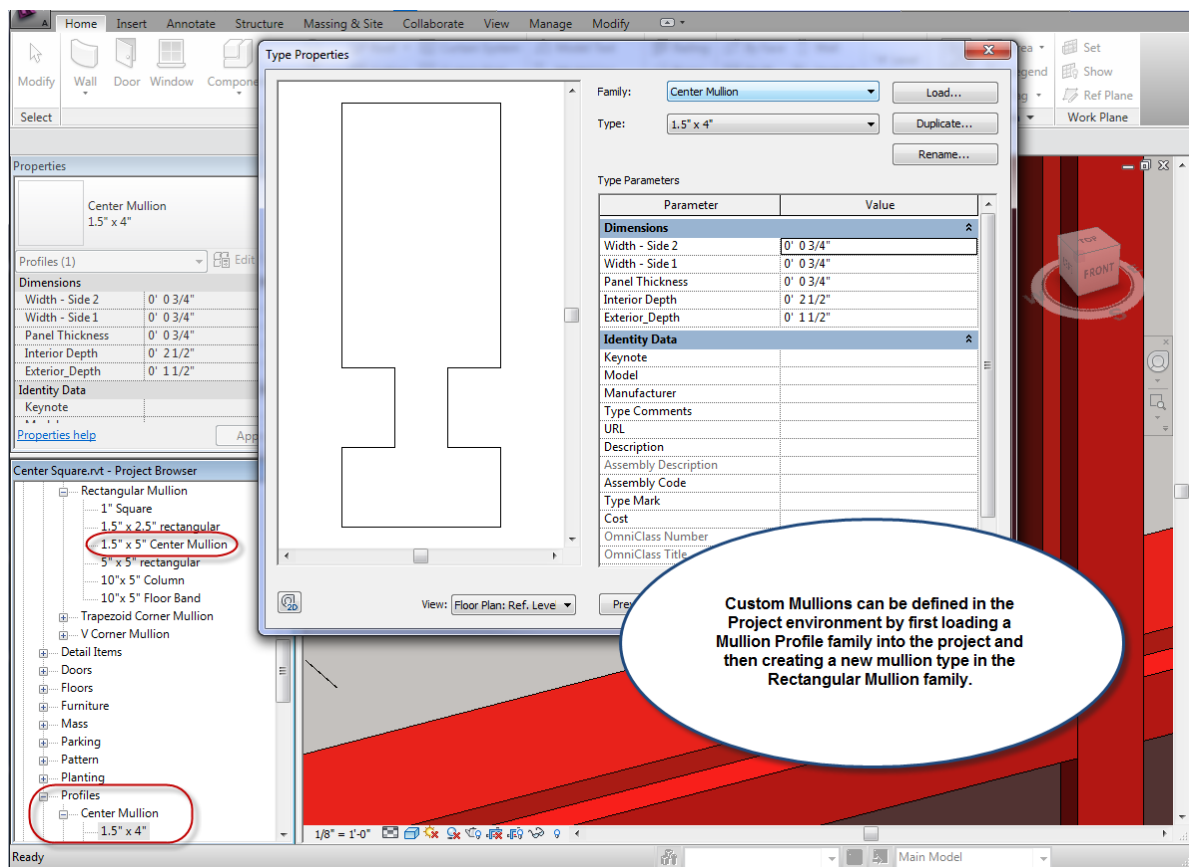


The Profile-template includes two Center reference planes and only a single Ref. Level view. As with all profile families, only 2D creation tools are available.

Profile families support basic visibility settings and you can include detail components nested inside the profile family. Detail information can be set to display only at a fine level of detail.

Profiles may be constrained and parameterized with labeled dimensions. Multiple types may be defined within the family by creating type variations in the Family Types dialog box.

Curtain Wall Mullion families are System Families with categories for Rectangular and Circular as well as the four predefined Corner mullion shapes. You cannot create additional categories or Families but you can create a new type within any of the six predefined categories. The most suitable choice is usually to create the new mullion type inside the Rectangular family.



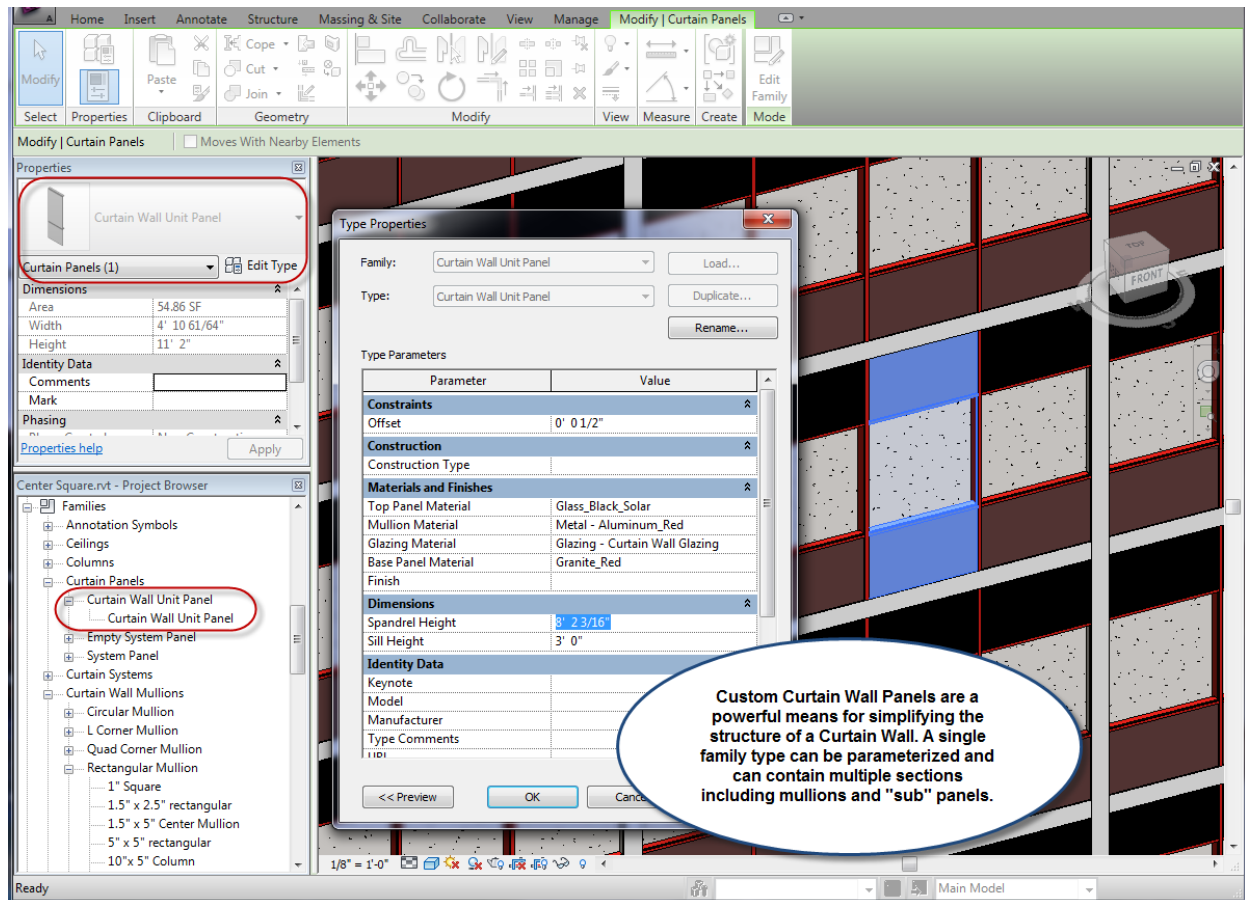
Mullion profile families can be loaded into a Revit project and then used to define new custom mullion types. Create as many types within the Profile family as required for different sizes of mullions.

After the mullion profile has been loaded, you can create a new Mullion type and in the Construction parameters assign the new custom profile.

Angle, offset, position and material parameters will still be available in the Custom mullion type but the Thickness setting and the two Width dimensions will be inaccessible. They will still display the correct distances but the actual values can only be modified in the Profile type properties.

Custom Curtain Wall Panel Families

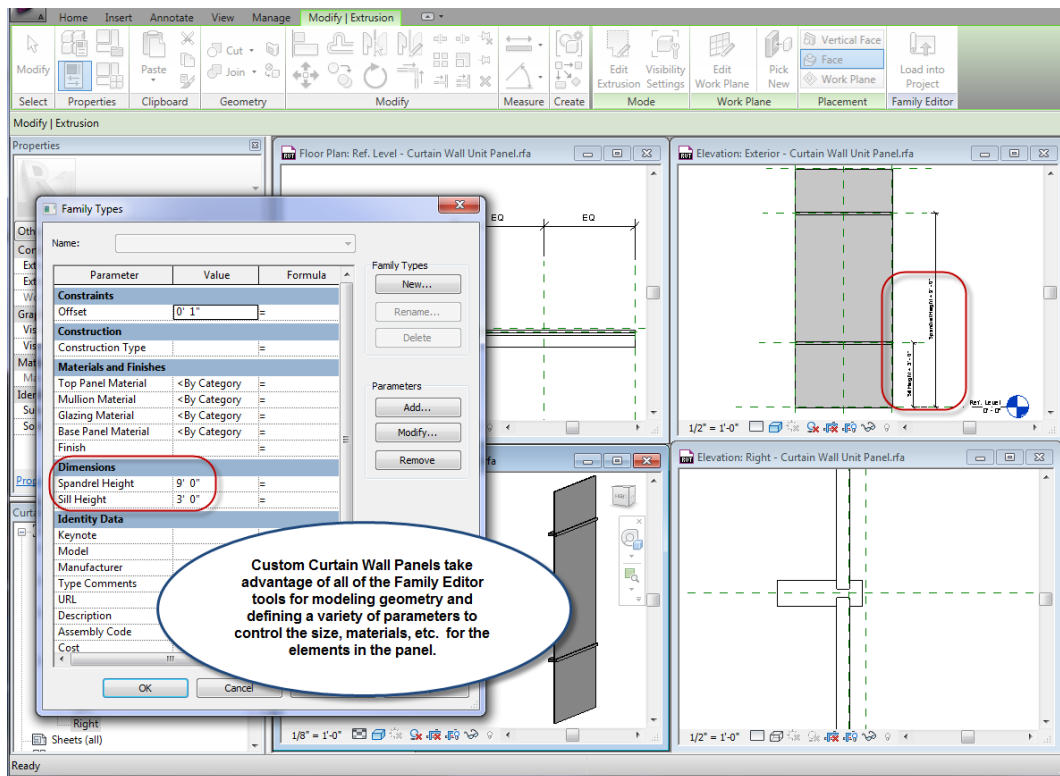
It is possible to define your own curtain wall panels using the Family Editor and the new Curtain Wall Panel family template. This allows you to create more complex panels than are possible with the default system panels.



Custom Curtain Wall Panels can be created with multiple sections of geometry so that a single "panel" family could actually contain a base panel, a glazed panel, a spandrel panel, and even nested mullions inside one element.

When you create a custom panel definition containing several elements, it can reduce the complexity of the curtain wall into which the panel is placed. This can greatly reduce the amount of time required to override default panel and mullion assignments in a complex curtain wall type.

To create a custom curtain wall panel family, take the same approach you would use to create a new custom component family. Start by developing a framework of reference planes and dimensioning anything that you want to parameterize with labels or constrain with locked dims.

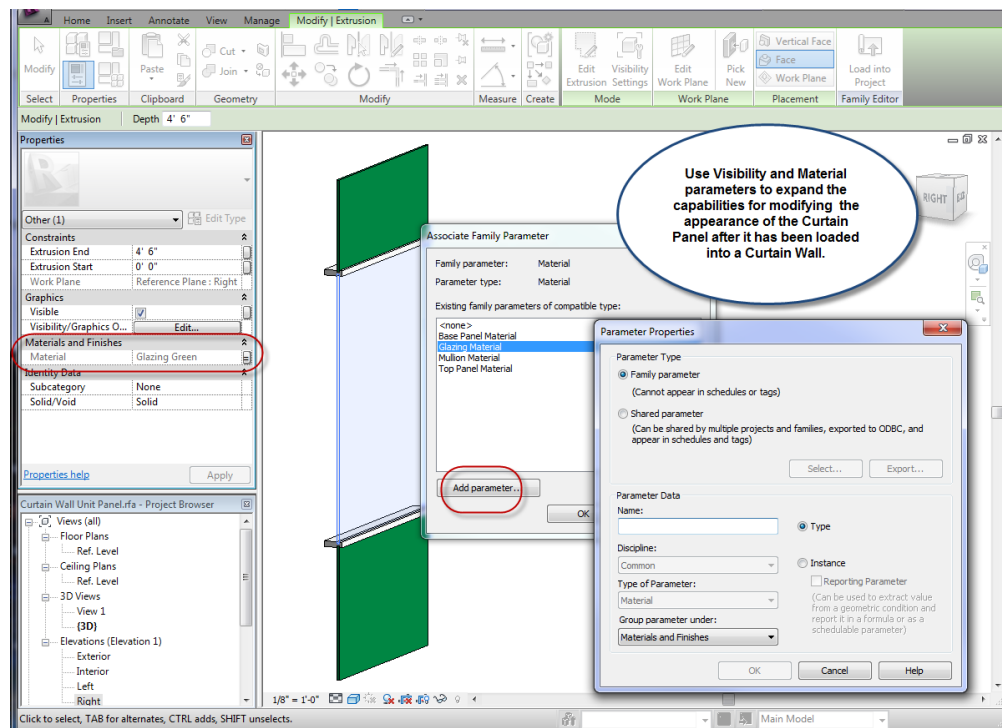


The Curtain Wall Panel template includes 5 starting reference planes. In the plan view there is a horizontal reference plane defining the front plane location of the curtain wall. If you add a second reference plane in front or behind the default Front reference plane, you can use the new one to coincide with the actual geometry and then add a labeled dimension called "Offset" which can be used to push or pull the panels in relation to its insertion point in a curtain wall.

This method of using a labeled dimension to set the position of the elements, will not allow for a negative value, so you will need to decide if you want the panel to shift out in front of the default position or shift back towards the interior. Add the geometry reference plane on the side you want the offset to be applied. Refer to the "Exterior" labels in the Top or side views to help confirm. Trying to set a negative value for the offset parameter in the project editor will produce an error and delete the custom panels if you attempt to continue.

Do not attempt to dimension the overall width or height of the curtain panel. The size of the panel will be constrained to the size of the opening into which it is loaded in its host curtain wall. If you want the panel to be 6 feet wide in the curtain wall, you need to create a host with vertical divisions 6 feet apart. If the gridlines are 12 feet apart, your custom panels will also stretch to 12 feet in width.

After testing the dimension parameters to ensure that the framework flexes properly, start creating geometry and constraining it to the reference planes.



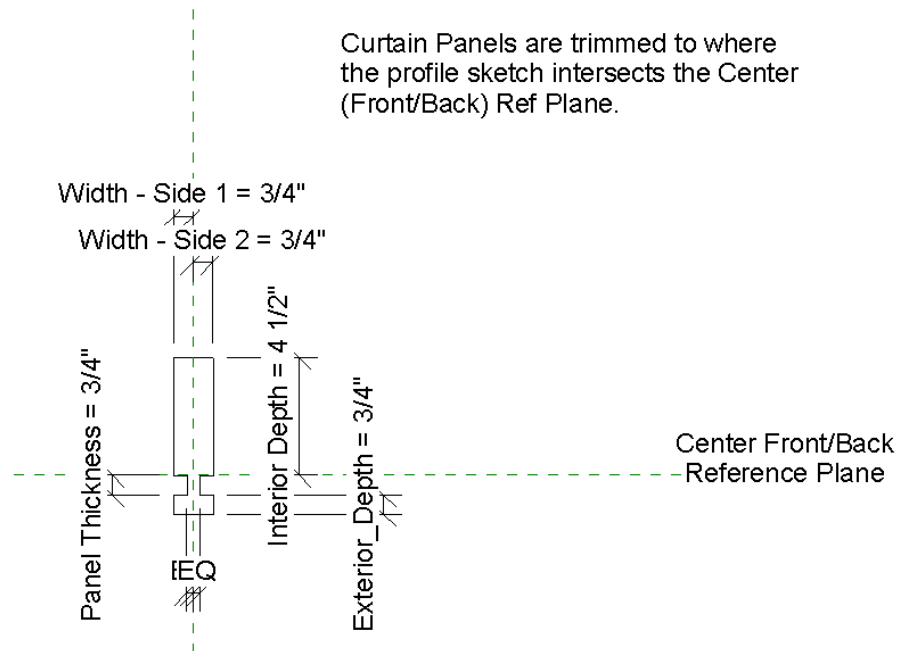
As you create extrusions or other sketched features, continue to flex the dimension parameters and create new parameters to control the appearance of materials. Visibility parameters can also be used to create optional components.

When the panel parameters are assigned and working properly, you can create additional types in the Family types dialog and then load the panel into the project. Edit the Curtain Wall which will use the panel and then assign it to the default curtain panel selection in the construction parameters. Use nested panels if necessary to define a Primary Grid for the entire wall, a Secondary Grid for the main bays, and then assign the custom panels in the main bay infill.

Exercise Notes

- In the following exercise you will learn how to create custom Curtain Wall Mullions and Custom Curtain Wall Panels and then use those custom elements in a series of nested Curtain Walls on the main Center wall in the Center Square project.
1. Start Revit and open the Center Square project. Select the main curtain wall in the middle of the building and open its Edit Type properties. Duplicate the type and create a new type called Center Wall. Set the Curtain Panel to System panel Glazed and the Join Condition to Border and Horizontal Grid continuous.
 2. Set the Vertical Grid Pattern to Maximum Spacing at 24'-0". Set the Horizontal Grid Pattern to Fixed Distance at 12'-0". Enable the Adjust for Mullion Size option for the Vertical Grid but leave it disabled for the Horizontal Grid.
 3. Under Vertical Mullions, set the Interior Type to the 10" x 5" Columns. Set both borders to use the 5"x5" rectangle. Under Horizontal mullions, set the interior type to 10"x5" Floor Band. Set the Border 1 type to 5"x5" rectangle and the Border 2 type to the 10"x5" floor band. Pick Apply and OK.
 4. The Curtain Wall still shows the manually added grid lines at 9 feet above each floor level. Tab-select over the mullions to highlight the grid lines and delete them. The wall should now display a series of rectangular bays, 24' wide by 12' high.
 5. Start the Wall tool, pick the Exterior Glazing curtain wall type, and draw a 24' long section of wall on Level 1, with a Base offset of 0" and a height of 12'. Pick the wall and choose Edit Type. Duplicate the type and call the new one Main Bay Infill. Set the Vertical Grid pattern to Maximum Spacing with a distance of 6'-0" and enable the Adjust for Mullion Size. Leave all other settings undefined or unassigned and pick OK.
 6. Pick the Center Curtain Wall and choose Edit Type. In the Curtain Panel assignment, choose the Curtain Wall: Main Bay Infill. Pick Ok. Each of the large bays in the wall should now show four equal vertical sections.

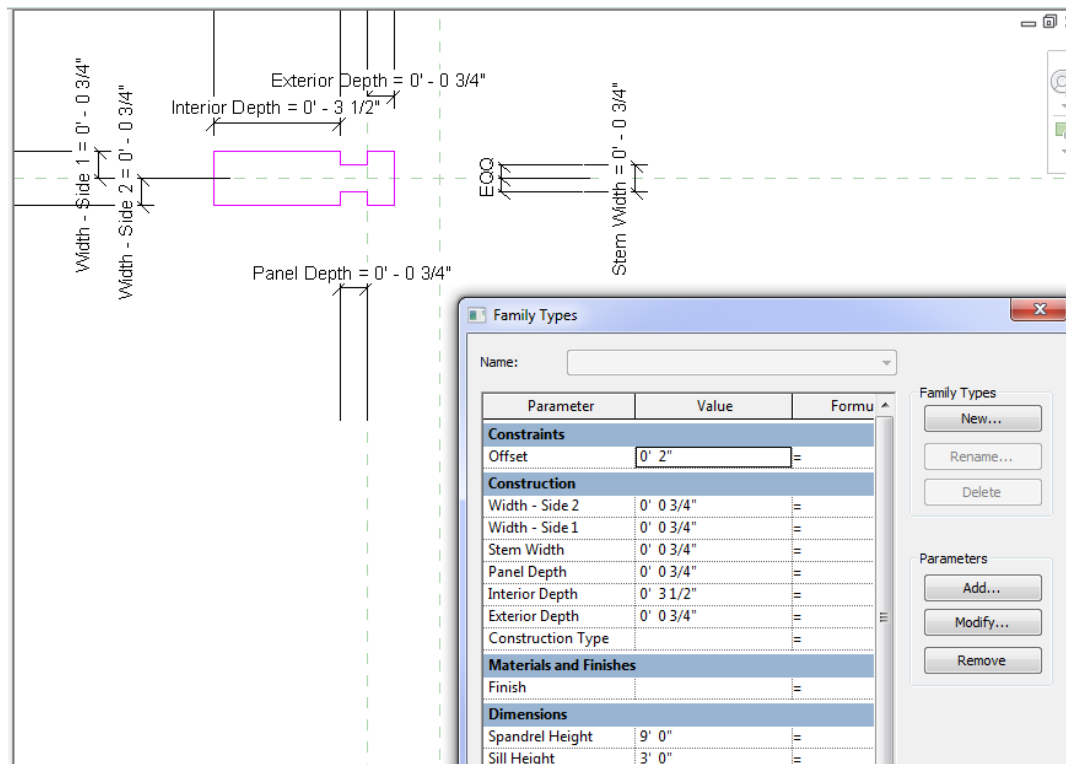
7. We're now going to define a custom mullion profile and custom mullion type to use in the Main Bay Infill. Create a new family and select the Profile-Mullion template. Create the profile as shown below including all five labeled dimensions to parameterize the size. Create two new types called 1.5" x 6" (shown below) and 2.5" x 6" which will use a 1-1/4" width for side 1 and side 2.



8. Save the Profile family as Center Mullion and then choose the Load into Project tool to add the profile to the Center Square project. In the Project Browser, expand the Curtain Wall Mullions category, right-click on the Rectangular Mullion family and choose New Type. Name the new type 2.5" x 6" Center Mullion. Open the Type Properties and in the Profile section assign the Center Mullion: 2.5"x6" type. Assign the Metal-Aluminum Red material and then pick OK.
9. Select one of the Main Bay Infill curtain walls and choose Edit Type. In the Vertical Mullions section, assign the Interior Type to use the Rectangular Mullion: 2.5"x6" Center Mullion. Pick Apply and Ok. Zoom in to the bottom frame along the Center Curtain Wall. The new mullion profile is in use but the mullions are not flush with the Rectangular 5"x5" mullion and are overhanging a bit at the back.

10. Pick the vertical mullion and choose Edit Type. Set the offset distance to 1" and pick Apply. The mullion shifts up so it is flush with the front of the border mullion but it still overhangs at the back. We could either increase the depth of the border mullion or decrease the depth of the vertical Center Mullion.
11. In the Project Browser, open the Profiles category, find the Center Mullion 2.5" x 6" profile type, pick it, right-click, and choose Type Properties. Reduce the Interior Depth value to 3.5" and pick Apply. The vertical mullion should resize to align with the border mullion. Rename the profile type to 2.5" x 5" and pick OK. Open the Mullion family and rename the Type to 2.5"x5" Center Mullion so it describes the size. Pick OK.
12. We are now going to create a new Custom curtain wall panel family which will have 3 nested panel sections divided by two integrated horizontal mullions. Create a new family and select the Curtain Wall Panel template. In the Ref Level view, add a new reference plane parallel to the Front reference plane and positioned a couple of inches on the interior side of the Front plane.
13. Select the new reference plane and Name it "Panel_Front". Add a linear dimension between the Front and the Panel Front. Label the dimension with a Type Parameter called Offset and group it under the Constraints section.
14. Switch to the Exterior elevation view and add two horizontal reference planes to divide the framework into 3 horizontal sections. Name the new reference planes Sill Height and Spandrel Height.
15. Select the top reference plane and drag it up to a height 12'-0". Select the two new reference planes you added and move them to 3'-0" and 9'-0" above the bottom level. Add dimensions to each of the two new planes and label the dimensions to create two new Type parameters called Sill Height and Spandrel Height, grouped under the Dimensions category.
16. Switch to the Right view. The Exterior is on the right hand side and the "Panel Front reference plane is positioned towards the interior. Zoom in the intersection of the Panel Front plane and the Sill Height Plane. We are going to sketch the same shape of mullion profile which we created in Mullion profile family but this one will be horizontal.

17. From the Home tab on the Ribbon, start the Extrusion tool. Sketch the rough shape of the Mullion Profile and then create some alignment constraints to align the front edge of the panel groove with the Panel Front reference plane. Add a series of dimensions as shown below and label them to create six Type parameters grouped under Construction.



18. Zoom back until you can see the Spandrel reference plane and then copy the Profile sketch and dimensions from the Sill reference plane up to the Spandrel reference plane. Any dimensions which used the Sill reference plane will be deleted in the new copy. Add the missing dimensions back and assign the associated labels. If you wanted the upper mullion to vary or be sized independently from the lower mullion, you could create more parameters and use different labels on the Sill profile and the Spandrel profiles. When all dims are in place, pick the Finish Edit tool on the Mode panel.
19. Switch to the Exterior view. Pick the extrusion and select the middle shape arrow defining the Start or End location for the extrusion. Drag the shape handles to align with the main Left and Right reference planes and lock the extrusion to the planes.

20. Switch to the Default 3D view and open the Family Types dialog. Try flexing the parameters to shift the sill height and the spandrel height. Flex the dimensions for the mullion profiles as well. Pick OK.
21. Select one of the mullions and in the properties palette choose the Associate Family Parameter button. Add a Mullion Material Type Parameter. Pick Ok. Open the Family Types dialog and assign a material to the Mullion Material parameter. Create a Metal- Aluminum Red material and pick Apply and OK.
22. Switch back to the Right or Left view. Create an Extrusion. Use a rectangle tool to define the profile for a single panel fitting between the grooves on the Sill and Spandrel mullion profiles. Lock the sketch to the Panel Front reference plane and the edges on the mullions so the rectangle is locked on all four sides. Pick Finish edit.
23. Switch to the Exterior view and align the extrusion start and end planes with the Left and Right reference planes. Try dragging the Sill Height and Spandrel Height reference planes up and down to dynamically flex the family and ensure that the panel resizes correctly.
24. Switch to a 3D view and pick the panel. Add a material parameter called Mid Panel Material. Create two more material parameters called Base Panel Material and Top Panel Material. Assign the Mid Panel Material and pick OK.
25. Switch back to the Right view and create two more panel extrusions for the Top Panel and the Base Panel. Create them as two separate extrusions and not as one extrusion with two loops.
26. Switch to the Exterior view and constrain the extrusion shape handles to the Left and Right reference planes. Switch to a 3D view and assign the Top Panel and Base Panel material parameters. Open the family types dialog. It is possible to include the material assignments in the panel family as we have done with the Red mullions, or wait and assign the actual materials in the project environment. Assign the default Glass material to the Mid Panel material parameter and leave the others set to "By Category". Flex the Sill and Spandrel heights and pick Ok. Save the family as Center Wall Panel and then Load into Project.

27. Select one of the Main Bay Infill curtain walls and choose Edit Type properties. In the Curtain Panel parameter, assign the Center Wall Panel type and pick OK. Pick one of the 6 foot wide Center Wall Panel units and choose Edit Type. Assign the Glass Black Solar to the Top Panel Material and the Granite Red to the Base Panel Material. Pick Apply and OK.
28. Zoom in to the base of the wall and examine how the custom infill panel is fitting in the Main Bay Infill. The offset distance is pushing the panel too far towards the interior. Select one of the panels and edit the Type Properties. Set the offset distance to 0" and pick OK. The offset is still too far. Pick the panel again and from the Ribbon choose Edit Family.
29. Select the Panel_Front reference plane and drag it from the interior side to the exterior side of the Front reference plane. This will modify the Offset parameter so its value will push the panel towards the exterior rather than towards the interior. Hit CTRL-S and then pick Load into Project.
30. Zoom in to the connection between the sill mullion on the panel and the vertical mullion in the Main Bay Infill of the wall and select one of the panels. Choose Edit Type and adjust the offset distance until the exterior faces of the mullions are aligned.
31. In the bottom section of the Center Curtain Wall, select one of the two middle Main Bay Infill panels and UnPin it. Choose Edit Type and Duplicate to create a new type called Door Bay Infill. Change the Curtain Panel assignment to System Panel – Glazed. Pick OK.
32. Add a horizontal grid line at 9' above the floor to the new panel. Add a mullion to the new grid line and set it to use the Center Mullion 1.5" x 6" mullion. Redefine the Mullion type and its associated mullion profile type to create a 1.5" x 5" Mullion. This will match the mullions used in the Center Wall Panel custom curtain panel.
33. Tab-select the left, vertical grid line in the Door Bay Infill and UnPin it. Change the dimension to move it to the left and set it 3'-0" from the column mullion. Repeat for the grid line at the far right of the panel. The two wider sections can now accommodate double doors. Select the left middle panel, unpin it, and change the type to Curtain Wall Dbl Glass.

34. Select the bottom mullion in the Door Infill Panel and delete it. We would like to have a revolving door in this area as well. Unfortunately, there are no revolving door families which are defined as Curtain Wall doors. As a matter of fact, the default libraries do not contain any revolving doors! Switch to the Insert tab on the ribbon and in the Autodesk Seek search bar, enter Revolving Door. There is one revolving door family on Seek. Open and download the latest version and choose to open the family in Revit.
35. Switch to a 3D view. Notice that this revolving door is hosted by a Basic Wall. That means that we won't initially be able to place it as a panel in a curtain wall. Fear not though! I have a plan! Open the Family Types dialog to review the available parameters but don't make any changes. Pick OK and then load the family into the Center Square project.
36. When the door appears in the type selector in the project environment, pick Modify or hit ESC to cancel. From the Build panel, pick the Wall tool and set the Type to a Generic 4" Brick. Draw a short segment of wall and then pick it and choose Edit Type. Duplicate the type to create a new Type called Basic Glass Wall. Pick Edit by the Structure parameter and change the Masonry brick material to Glazing: Curtain Wall Glazing. Set the thickness to $\frac{3}{4}$ " to match our typical panel thickness. Pick Ok and Ok to close the Type properties.
37. Delete the sample wall and then select the glazed panel beside the double glass doors. Unpin the panel and in the Type Selector assign the Basic Glass Wall. Zoom in to the base of the wall and adjust the Location Line Offset until the panel aligns with the groove in the adjacent mullion.
38. From the Build panel, start the Door tool and in the Type Selector pick the 72" diameter Revolving Door. Add the door to the Glass Wall panel. Pick the door and choose Edit Type. Duplicate the door type and create a new one called 82" Diameter. Set the height to 8'-11" and the Top Thickness to 1'-0". Set the diameter to 82". Change the Metal Chrome material to Metal Aluminum. (Chrome appears Black in shaded views.) Pick OK.
39. Select the upper panels above the doors and Unpin them. Assign the Glass Black Solar panel type and then edit the type and adjust the offset distance to 1-3/8". Pick Ok.

40. Use the Curtain Grid tool and set it to All Except picked. Add a grid line 3 feet above the base level that divides the sidelight panels but does not affect the door panels. Use the Mullion tool to add a 1.5" x 5" Center Mullion along the new grid line segments. Add a 5" x 5" rectangular mullion to the bottom segments under the Sidelights. To finish the Door Bay Infill, select the glazed panels in the bottom section of the sidelights, Unpin them, and then assign the Granite Red panels.
41. Repeat the customization process for the second Door Bay Infill to create a mirrored version of the one we developed over the previous few steps.
42. If you zoom into the inside corner between the Center Wall and the adjacent side wall, you'll see that the mullions and panels do not align. It would be possible to customize the grid line positions to try to align them between the two walls but it will be simpler to swap the Exterior Glazing and Customized Side walls with the new Center Wall curtain wall type. If you attempt to change this directly, from one curtain wall type to another, it will retain any custom grid lines, and you will need to delete them one at a time. A slicker way to do this is to pick the curtain wall you want to change and first change it to a Basic Wall type and then change it to the new curtain wall type.
43. Select the Exterior Glazing Curtain Wall that we first developed. In the type selector, set it to the Exterior Brick on CMU wall type. Select the wall again and change it the Center Wall Curtain Wall type.
44. Repeat the previous step to change the customized Side wall to the Center Wall curtain wall type as well. Select the lower section of the main vertical mullions and use the Clean Join toggle to make them cut through the lower horizontal border mullion.
45. Assign a V Corner mullion on the inside corner between the Center wall and the Side Wall. Duplicate the type to create a 7.5" x 7.5" version. Assign an L Corner mullion to the outside corner between the curtain walls. Assign the Quad Corner mullion to the corner between the masonry wall and the curtain wall. Adjust the length of the curtain wall as required to make the mullion flush with the masonry. Adjust all main vertical mullions to cut the bottom border mullions.
46. Review the appearance of the connections at the corners of the building between the curtain walls and the brick walls and use the Align command to adjust the faces. If you do this at the upper corners, you can also align the roof faces to help clean up any gaps or overlaps.
47. Save and close the file.